If we would have a quantum computer what can we do with it?

Simulation of Ideal and Physical Quantum Computers

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A brief introduction to the basics of quantum computation is given. We present a generic physical model of quantum computer hardware and compare ideal and physically realizable quantum computers. The physical model is used to simulate quantum computer hardware on conventional computers.

We address the issue of reliable quantum computation on physically realizable hardware. We demonstrate that in the absence of decoherence or dissipation, physically realizable quantum computers operate in a regime of extreme sensitivity. This high sensitivity reflects itself in problems of programming physical quantum computers such that they perform correct calculations.
We also discuss the effects of the interaction of the qubits with other spin degrees of freedom.

Additional information can be found on
http://www.compphys.org/quantum.htm